

INTERSCAPULO-THORACIC AMPUTATION.¹

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(Concluded from page 64.)

THERE are yet other cases which will not admit of classification with any of the foregoing, cases in which either resection of the humeral head or of the scapula has preceded interscapulo-thoracic amputation, and these I have placed separately. These are the cases of Syme, Fergusson, Hamilton, Desprès, and Madelung, five in all. One of these, that of Madelung, is incorrectly incorporated by Berger in his table of 1898 as a primary interscapulo-thoracic amputation, though he admits that a resection of the head of the humerus was done six years before by Trendelenburg. Four of these cases recovered; and in the other case (Hamilton) there is not sufficient data. In two of the cases, Syme's and Madelung's, there had been resection of the humeral head; in three, resection of the scapula. As for recurrence, the data is insufficient in two cases; two cases were in good health one year after interscapulo-thoracic amputation had been done, and one died in seven months from recurrence in the peritoneum. The effect of adding these as well as the previous cases to the table of typical cases would be to still further lower the mortality of the operation to ten per cent.; raise the number of apparent cures to sixteen, and the number of cases of recurrence to twenty, making the percentage of ultimate cures over forty-four.

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(III) CASES OF INTERSCAPULO-THORACIC AMPUTATION PRECEDED BY RESECTION OF THE SCAPULA OR OF THE HUMERAL HEAD.

CASE LXXVIII (1862, September 16, 1863, January; 1863, May 7. J. Syme, Edinburgh. Male, aged forty. Osteofibro-cartilaginous tumor, which had been in existence for one year. (1) Resection of the head of the humerus. (2) Removal of the growth from the shoulder. (3) Interscapulo-thoracic amputation. After the second operation the tumor recurred in the scapula. At the third operation nineteen arteries were ligated. Recovery. No recurrence one year after the operation. Reference, Syme, "Excision of the Scapula," Edinburgh, 1864.

CASE LXXIX (1865, January 14; November 11).—William Fergusson, London. Female, aged nineteen. Fibro-recurrent tumor of the infraspinous fossa. It had been present four years. (1) Resection of the infraspinous fossa of the scapula. The tumor, when removed, was the size of a cocoanut. (2) Interscapulo-thoracic amputation. Recovery. After the first operation the tumor recurred in June of the same year. There was a good functional result following the first operation. No data concerning the final result. Reference, *Lancet*, London, 1865, Vol. ii, pp. 233 and 592; *Medical Times and Gazette*, 1865, Vol. i, pp. 62 and 592; also Vol. ii, pp. 574 and 706.

CASE LXXX (1865, February 15, 1868; February 12, 1870; December 13).—Hamilton, New York. Male. Colloid tumor. (1) Resection of the anterior border of the scapula; (2) Resection of a small part of the scapula; (3) Interscapulo-thoracic amputation: recovery(?). There was no recurrence following the first operation until January, 1868. Reference, *New York Medical Record*, 1871-72, Vol. vi, p. 141.

CASE LXXXI (1881, December; 1882, June 19).—A. Desprès, Paris. Male, aged twenty-two. Osteosarcoma. (1) Resection of the infraspinous portion of the scapula; (2) Interscapulo-thoracic amputation. Recovery. Death in seven months from metastasis in the peritoneum and post-peritoneal glands. There was a history of injury eleven years before the first operation. The tumor had been present for two years and a half. Recurrence took place three months after the first operation. The subclavian vessels were ligated preliminarily. Air entered the vein and caused syncope. Reference, *Bulletin de l'Académie des Sciences*, T. vi, revue par Am. Desprès, Paris, 1884, p. 968.

CASE LXXXII (1880, February; 1886, December 9).—Trendelenburg,

lenburg, Madelung. Male, aged forty-two to forty-eight. Enchondroma molle of the left humerus following a blow in 1878. (1) Resection of the head of the humerus; (2) interscapulo-thoracic amputation: recovery. The patient was able to resume his work about two months after the first operation. In 1883 he fell on his shoulder, and since then a tumor gradually developed, until at the time of the second operation it had become as large as a man's head. Preliminary ligation was found impossible. The Esmarch bandage was used. Reference, *Deutsche Zeitschrift für Chirurgie*, 1882, Vol. xxv, 330; *ibid.*, 1888, Vol. xxvii, p. 238.

Two cases were operated upon by this method for *carcinoma of the breast*, involving the vessels and shoulder region. Morisani and Treves each report one case. Morisani's case died four hours after the operation. Treves's case recovered, and was greatly benefited in regard to freedom from pain and greater of general comfort.

(IV) INTERSCAPULO-THORACIC AMPUTATION FOR CARCINOMA OF THE BREAST.

CASE LXXXIII (1885, March 15).—Domenico Morisani, Naples. Female, aged fifty-four. Carcinoma of the right breast, axilla, and shoulder-joint. The tumor had been growing between sixteen and seventeen years. Interscapulo-thoracic amputation with removal of the clavicular portion of the tumor. In addition to this, the second, third, and fourth ribs were resected. Preliminary ligation of the subclavian vessels was practised. Death followed, four hours later, from shock. Reference, *Il Morgagni*, Agosto, Ottobre, 1885, Vol. xxvii, p. 505.

CASE LXXXIV (1891).—Frederick Treves. Female, aged fifty-seven. Recurrent carcinoma of the right breast. The original tumor had been removed two years previously. There was intolerable pain and great œdema of the arm. Interscapulo-thoracic amputation: recovery. The patient was much more comfortable after the operation. Reference, *Lancet*, London, 1891, Vol. ii, p. 59.

There yet remain three cases which I have been compelled to leave unclassified.

(V) UNCLASSIFIED CASES OF INTERSCAPULO-THORACIC AMPUTATION.

CASE LXXXV (1872, April 23; 1875, March 9; 1876, September 5; 1877, April 15; 1878, January 29; 1879, March 20).—

Kappeler, Münsterlinger. Female, aged twenty-five. Chondroma. (1) Resection of the infraspinous portion of the scapula; (2) further resection of the scapula; (3) resection of part of the acromion; (4) further resection of the acromion and coracoid; (5) removal of the clavicle; (6) disarticulation at the shoulder-joint. Recovery. In March, 1880, the patient was still free from recurrence. Death from recurrence took place less than a year after this. Reference, H. Walder, "Ueber Chondrom der Scapula," Dissertation, Leipzig, 1881.

CASE LXXXVI (1888).—John A. Wyeth. Female, aged fifty-five. Sarcoma of the deltoid. Interscapulo-thoracic amputation. Half of the scapula was left. Recovery. Recurrence took place, and death ensued eight months after the operation. Reference, *New York Medical Journal*, 1891, Vol. i, p. 57.

CASE LXXXVII (1889).—Von Bergmann. Female, aged thirty-eight. Sarcoma of the right humerus. Interscapulo-thoracic amputation with resection of the first rib and part of the sternum. Ligation of the superior vena cava and the right brachio-cephalic trunk. Died two hours after the operation. The muscles were extensively involved in this case. There had been a pathological fracture of the humerus. Reference, Nasse, Berger.

(VI) CONSECUTIVE INTERSCAPULO-THORACIC AMPUTATION.

Cases in which removal of the scapula and clavicle followed disarticulation at the shoulder-joint, twenty-six cases.

CASE I (1831, November 3; 1837, September 28).—R. D. Mussey, Cincinnati. Male, aged twenty-seven. Chondroma undergoing sarcomatous changes. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and clavicle. Recovery. When the patient was twenty-seven years of age two bony tumors were removed, with the metacarpal bone of the thumb and the distal half of the metacarpal bone of the forefinger. One was larger than a hen's egg, the other somewhat smaller. Both were upon the right hand. Two years later pain was felt in the arm. This was more or less constant for eleven years. During the last two years of this period the pain was mostly in the region of the shoulder. During the last year the soft parts about the upper arm and shoulder enlarged to twice their normal size. In 1831 (thirteen years after the first operation) the arm was disarticulated at the shoulder-joint. Five years later the stump became painful and a tumor appeared. In 1837

the clavicle and scapula were removed with the tumor. Air entered the subclavian vein during this operation. There was no recurrence thirty years later. Reference, *American Journal*, 1837, Vol. xxi (Old Series), p. 390.

CASE II (1835).—Crosby, of Hanover, U. S. Male, aged thirty. Osteosarcoma. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and clavicle (the sternal end of the clavicle was not removed). Recovery. Died from metastasis in the lumbar vertebrae four years later. This case was never reported by the operator, but his son, Professor A. B. Crosby, sent an account of the case to Stephen Rogers. Reference, *New York Medical Journal*, 1869, Vol. viii, p. 434.

CASE III (1841, May 9; 1842, 10 months later).—Rigaud, Strasbourg. Males, aged fifty and fifty-one. Osteosarcoma. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and clavicle (outer end). Recovery. No recurrence three years after the second operation. The tumor had been present since 1835. It had recurred in the cicatrix eight months after the first operation. In consequence of the ligation of the axillary artery at the first operation the subclavian was found obliterated. Reference, *Archives générale*, 1844, p. 521; also A. Pfrenger, "Ueber die Resection der Schulterblättern," Dissertation, Würzburg, 1846, p. 10; also *Gazette médicale de Strassbourg*, 1884.

CASE IV (1842 ?).—Conant. Male. Cancer. (1) Disarticulation of thumb; (2) disarticulation of wrist; (3) amputation of forearm; (4) amputation of the arm; (5) disarticulation at the shoulder-joint; (6) removal of the scapula and clavicle. Recovery. No recurrence after twenty years. Reference, *Presse médicale Belge*, 1863, Vol. xv, p. 344; also *Dublin Medical Press*; also *American Medical Times*.

CASE V (1857, February 17; April 21).—Soupart. Male. Fibroplastic tumor. (1) Disarticulation at the shoulder-joint; resection of the acromion, glenoid cavity, and anterior border of the scapula; (2) removal of the remainder of the scapula. Recovery. Recurrence took place in the wound in three weeks, and death ensued on July 12 of the same year. Reference, *Gazette médicale de Paris*, 1866, p. 277; also, *Annales de la Société de Médecine de Gand*, 1858, Vol. xxxvi.

CASE VI (1859, November 25; 1860, April 14).—Von Langenbeck. Male, aged twenty-three. Fibrosarcoma of the upper epiphysis of the humerus. (1) Disarticulation at the shoulder-joint; (2)

removal of the scapula and three-fourths of the clavicle. Recovery. Death from recurrence in the lung one and one-half years later. The first recurrence was in the supra- and infraspinous region and in the acromion. At the second operation the subclavian artery was ligated preliminarily. Reference, *Deutsche Klinik*, 1860, p. 217; also, Von Langenbeck's *Archiv*, 1862, Band. iii, p. 306.

CASE VII (1861, May).—Wilh. Busch, Bonn. Female, aged sixteen. Osteosarcoma of the left humerus with axillary involvement. (1) Disarticulation at the shoulder-joint and removal of the axillary glands; (2) removal of the scapula and the greater part of the clavicle. Recovery. Recurrence occurred in the shoulder-girdle five weeks after the first operation. At the second operation the subclavian artery was ligated preliminarily. There was no recurrence six years after the operation, when the patient died of typhoid. Reference, Adelman, personally communicated by the author.

CASE VIII (1863, 1868).—Krackowizer. Enchondroma. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula without the clavicle. Died in seven days from exhaustion. Reference, *New York Medical Journal*, 1869, Vol. viii, p. 440.

CASE IX (1864).—Déroutbaix, Brussels. Malignant tumor. (1) Resection of the head of the humerus; (2) disarticulation at the shoulder-joint; (3) removal of the scapula. Recovery. Death in one month from recurrence in the lungs. Reference, *Gazette médicale de Paris*, T. xxi, p. 277; Adelman, communication from Michaux.

CASE X (1864).—Gurdon Buck. Male adult. Osteocancer. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and clavicle. Recovery. Died from recurrence in a few months. Reference, *American Journal*, 1868, N. S. 56, p. 371.

CASE XI (1869, 1870?)—Rigaud, Strasburg. Male. Osteophyte. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula one and one-half years later. Recovery. No recurrence six years later. Recurrence took place in the scapula after the first operation. Reference, *Centralblatt für Chirurgie*, 1876, No. 33, p. 528; *Bulletin de la Société de Chirurgie*, Paris, 1875.

CASE XII (1872, January; July).—Daniel Stimson, New York. Male, aged forty-two. Fascial sarcoma. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and part of the clavicle. No final result is noted. There had been a fracture of the humerus two years before. There was a rapid recurrence after the first operation. Reference, *New York Medical Record*, 1872, Vol. vii, p. 578 (December 16).

CASE XIII (1873, August, December 14).—C. S. Jeaffreson. Female, aged twenty. Encephaloma (osteoid cancer) of the upper extremity of the left humerus, rapid in growth. A few weeks before the operation there had been a spontaneous fracture of the humerus. (1) Disarticulation at the shoulder-joint. There was rapid recurrence in the wound and pectoral region. (2) Removal of the scapula and three-fourths of the clavicle. Recovery. No subsequent data. Reference, *Lancet*, London, 1874, Vol. i, p. 759.

CASE XIV (1878, December; 1879, November 14).—Aniello a' Ambrosio. Female, aged eighteen. Fascial sarcoma. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and the outer part of the clavicle. The tumor had been present for six months, and was the size of a child's head. Recurrence in the cicatrix took place after the first operation. Preliminary ligation of the subclavian artery was done. Air entered the vein. Death in eighteen days from infection. Reference, "Ricerche di patologia e di clinica chirurgica," Naples, 1883, Vol. i, p. 1.

CASE XV (1881, January 15; June).—John Wood. Female, aged seventeen. Sarcoma of the left humerus of three months' history. (1) Disarticulation at the shoulder-joint. In April the disease recurred in the scapula. (2) Removal of the scapula and one-half of the clavicle. The subclavian was compressed after division of the clavicle. Very little blood was lost. Died the same evening of shock. Reference, *Lancet*, London, 1881, Vol. i, p. 952.

CASE XVI (1882, February 7; August 30).—W. J. Conklin. Female, aged thirty-seven. Osteosarcoma. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and three inches of the clavicle. Recovery. After the first operation recurrence took place in the scapula in three months. The original tumor had been present for six years. The patient finally died twenty-five months after the operation from recurrence in the lung. Reference, *American Journal*, 1883, N. S., Vol. lxxxv, p. 102.

CASE XVII (1885, November 27; 1886, July 22; 1887, January 24).—Von Bergmann. Male, aged seventeen. Sarcoma of the left forearm. (1) Amputation above the elbow; (2) extirpation of the tumor in the axilla; (3) removal of the scapula, clavicle, and the rest of the humerus. Recovery. There was rapid recurrence after the first operation. Recurrence took place three months after the second operation. Preliminary ligation of the subclavian artery and vein was done at the third operation. No subsequent data. Reference Bramsfeld, Dissertation.

CASE XVIII (1886, February 11; April 24).—Paul Swain, Plymouth. Male, aged eighteen. Myeloid sarcoma. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and part of the clavicle. Recovery. The tumor was of two months' duration. It recurred in the scapula one month after the first operation. Died of pneumonia within six weeks of the operation. Reference, *Lancet*, London, 1887, Vol. i, p. 20.

CASE XIX (1886, March 13; 1888, June 8).—Wats. Male, aged thirty-one. Fascial sarcoma of the humerus. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and clavicle. Recovery. After the first operation the disease recurred in the scapula. There was rapid recurrence after the second operation. Reference, Schultz, 12, p. 456.

CASE XX (1887; 1889, August).—Von Eiselsberg. Male, aged forty. Chondrosarcoma. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and clavicle. Recovery. Recurrence took place in the shoulder region after the first operation. The final result is unknown. Reference, Schultz, 21, p. 457.

CASE XXI (1888, April 13; 1888, May 30).—Wats. Male, aged fourteen. Sarcoma. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and clavicle. Recovery. Recurrence took place in the scapula after the first operation. Death from recurrence within four months. Reference, Schultz, 10, p. 455.

CASE XXII (1890; four months later).—B. Jessett. Male, aged twenty-two. Myeloid sarcoma of the humerus. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and one-half of the clavicle. Recovery. Five weeks before the second operation the disease recurred in the scar and was removed. No further data. Reference, *Lancet*, London, 1890, Vol. i, p. 131.

CASE XXIII (1891).—Von Bergmann. Sarcoma. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and clavicle. Recovery. The site of the recurrence, after the first operation, is not stated. Death from recurrence. Reference, Schultz, 36, p. 459.

CASE XXIV (1893, March; August).—Jordan. Male, aged twenty. Chondrosarcoma. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and the clavicle. Recovery. Recurrence took place nine months later. The site of the recurrence, after the first operation, is not noted. Reference, Heddæus, Case II, *Beiträge zur klinische Chirurgie*, 1897, Vol. xviii, p. 775.

CASE XXV (1896, April 5; 1897, August 23).—R. Humphrey Martin. Female, aged twenty-six. Spindle-celled sarcoma of the

upper extremity of the humerus, of six months' growth. (1) Disarticulation at the shoulder-joint. The patient suffered greatly from shock. Recurrence took place over the dorsum of the scapula sixteen months after the operation. (2) Removal of the scapula and two-thirds of the clavicle. There was no shock. Recovery. Death from recurrence in the thorax about one year later. Reference, *Inter-colonial Medical Journal of Australasia*, 1898, Vol. iii, pp. 482-485.

CASE XXVI (1896, June).—Quénu. Female, aged twenty. Sarcoma. (1) Disarticulation at the shoulder-joint; (2) removal of the scapula and clavicle. Recovery. Recurrence took place after the first operation in the cicatrix and deltoid. Duplay did the first operation. Death occurred eight months after the second operation from lung involvement. Reference, Berger, *Revue de Chirurgie*, 1898, p. 881.

Site of Recurrence after Disarticulation of the Shoulder-Joint.—

In nine cases the site is not noted; seven cases recurred in the scar; eight in the scapula; one in the scapula and clavicle; one in the "shoulder region."

Variety of Tumor.—Twenty of these cases were varieties of sarcoma. There was one reported as cancer; one fibro-plastic tumor; one enchondroma; one malignant tumor; one osteophyte; and one encephaloma.

Mortality.—Three cases died as a result of the operation: No. VIII, in seven days from exhaustion; No. XIV, in eighteen days from infection; No. XV, the same evening from shock. In one case, No. XII, the result is not noted. All the other cases recovered. This makes the mortality 12 per cent., slightly higher than that of the primary operation. Removal of the scapula and clavicle, consecutive to disarticulation, has a mortality of about 13 per cent. According to Berger, Schultz reached the same conclusion. Only cases reported subsequent to 1875 were used in their conclusions. It is when interscapulo-thoracic amputation is done for tumor of the scapula that the highest mortality occurs. This can be readily explained. When the operation is done for tumor of the humerus, preliminary ligature of the axillary or subclavian is comparatively easy and hæmostasis readily accomplished; on the other hand, tumors of the scapula, by reason of their size and location, render pre-

liminary ligation of the subclavian vessels uncertain, very difficult, and in some cases impossible; for instance, the enormous pathological development of the vessels in the neighborhood of the tumor, particularly the superior scapular artery and vein, and the posterior scapular artery and vein, increase greatly the chances of severe hæmorrhage during the subsequent stages of the operation. In addition, involvement of the scapular and clavicular muscular attachments render the operation still more difficult, and the case much more prone to relapse.

Final Results.—In arriving at the percentage of final recoveries, we set aside those cases which died as a result of the operation (Nos. VIII, XIV, XV), the one case which died of intercurrent disease soon after the operation (No. XVIII), and three in which there is no record of the final result (Nos. XII, XIII, XVII, XX, XXII). Twelve of the remaining cases died of recurrence (Nos. II, V, VI, IX, X, XVI, XIX, XXI, XXIII, XXIV, XXV, XXVI). Five cases are classed as cured. Of these, that of Mussey (No. I) was alive and well thirty years after the last operation; that of Rigaud (No. III) three years afterwards; that of Conant (No. IV) twenty years; Busch (No. VII) six years; and the Rigaud second case (No. XI) six years. If we allow the question of malignancy in these five cases to pass undisputed, we find that 29 $\frac{2}{3}$ per cent. made an ultimate recovery. That these cases were malignant is proved by the number of times each recurred. Three were diagnosed clinically as sarcoma, one as an osteophyte, and one as cancer. Berger included in his table of twenty-three cases but four of these cases as cured, but I have corroborated each of them. He further states that two of his four cases were reported two and four months respectively after the removal of the scapula; but my researches prove that three cases were well three years and more after the operation, and hence must be classed as final cures. He disputes the malignancy of Rigaud's second case (No. XI of this list), which was well six years after the operation, by saying that the diagnosis is vague, the term "osteophyte" being used. However vague the term may be, there is no doubt of the malignancy of a case which, after disarticulation at the shoulder-joint, recurred in the body of the scapula.

He even doubts that the remaining case, Conant's, was malignant. This case (No. IV of our list) had the term osteocancer applied to it. Five operations, ranging from disarticulation at the thumb to disarticulation at the shoulder, were performed before the final removal of the scapula and clavicle; yet Berger doubts the malignancy of the growth! There is scarcely a case in his table which may be called cured, according to Berger. His idea in claiming the vast superiority of primary interscapulo-thoracic amputation over consecutive interscapulo-thoracic amputation is correct, but he overdoes the matter in claiming that there are no cures after the consecutive procedure.

The superiority of primary interscapulo-thoracic amputation is amply proved by a comparison of the preceding tables. The mortality of this operation is less than that of the consecutive operation. While at the very outside limit the consecutive operation has cured 29 $\frac{2}{5}$ per cent., the primary operation has cured over 56 per cent.

It is but natural to suppose that an operation which allows of so much more radical treatment of the disease, as does interscapulo-thoracic amputation, as compared with simple disarticulation, should offer much greater hope for permanent relief. That it is necessary to go wide of the disease, especially in the case of sarcoma, no one will doubt. It is a fact that sarcoma offers a very bad prognosis as treated by present methods. Taking disarticulation of the hip for sarcoma of the femur, for example, out of eighty-seven cases collected by Borck and traced, not a single instance of definite cure can be proven. In the case of the femur we are limited by the os innominatum in our endeavor to extirpate the disease; but in the case of the humerus we are not limited. There is presented for our consideration an operation the mortality of which is less than a disarticulation at the hip-joint, and less than the mortality of disarticulation at the shoulder. It has the merit, also, of going wide of the disease for which it is done. By performing it we do all that can be done towards radically relieving our patient of a disease which, if treated by palliative operative procedure, invariably leads to a fatal termination.

It is well known that amputation through the bone above

that affected by osteosarcoma gives the best results, so far as local recurrence is concerned. Poncet, Gross, and Schwartz have called attention to this point. The number of recurrences following disarticulation at the shoulder-joint show conclusively the need for a more radical operation. Gensoul, Daniel Gilbert, and Humphrey have advocated more or less extensive resection of the scapula in addition to disarticulation. Keen, of Philadelphia, in a paper read before the American Surgical Association in 1895, in one line states that interscapulo-thoracic amputation "is perhaps also indicated in tumor of other parts of the humerus (than the superior extremity) invading the soft parts." Pathological examination of these cases show that the scapula muscles are more frequently the site of the recurrence, hence the additional partial resection of the scapula is not sufficient. To be of benefit the entire scapula and muscles must be removed primarily, not as a secondary procedure. When the muscles of the scapula are perceptibly involved, rapid recurrence is almost certain. Out of seven cases operated upon by Bergmann in his clinic in Berlin four showed involvement of the scapula at the time of operation, and these promptly died, two of local recurrence and two of generalization of the disease; in the other three cases the scapula muscles were not involved, and these cases remained free from the disease when last heard from, one for ten months, one for one year (dying of some unknown disease), and one for three and a half years. These were all cases of sarcoma. Moreover, the operation also offers a complete clearing or rather an obliteration of the axilla, and the soft parts in the neighborhood, and while sarcoma does not necessarily extend through the glands, results have conclusively shown, I think, that the soft parts in and around the axilla are quite frequently the seat of disease even when an appreciable thickening or tumor is not discoverable by palpation. One must verily have a microscope in the finger-tips to definitely say just where tissue containing sarcomatous elements ceases and normal tissue begins. Absolutely the only safe plan to pursue is to remove all the tissue that is compatible with the maintenance of life, so that if recurrence occurs, we have no possible reproach from our conscience. Having given a case the benefit

of interscapulo-thoracic amputation we have done all that human hands can do to prolong, and perhaps save, the patient's life.

The question is not, shall a resection or a disarticulation be done, but will even an interscapulo-thoracic amputation remove all the disease? What surgeon is there so wise who will lay his hand on the scapula or clavicle, or tissues in the axilla, or neighborhood of the shoulder-joint, in a case of sarcoma of any portion of the humerus, and say, "The disease has not extended thus far"? Just as in the case of sarcoma of the femur, not a single case of permanent cure can be proved; so I believe, in the case of the humerus, that disarticulation is but a palliative measure. It should be one of the cardinal axioms of surgery that sarcoma of a long bone is not cured by extirpation of that bone alone, for the reason *that in the vast majority of cases healthy flap-structures cannot otherwise be obtained than by going through the bone above.*

CONCLUSIONS.—As a result of a study of the above cases, and a study of many others which have died from recurrence following disarticulation and other palliative operations, I believe it may safely be considered proved that (1) sarcoma of the humerus offers slight chance of ultimate cure by any but the most radical procedure. (2) The operation of choice for sarcoma of any part of the humerus is primary interscapulo-thoracic amputation.

Prothesis.—Berger and Adelman have each described a prothetic apparatus for use following interscapulo-thoracic amputation. It is claimed that this is fully as useful as the apparatus for use following disarticulation at the shoulder. However this may be, it need hardly influence the decision as to the operation when the immense advantages of the complete amputation is considered.

Four other cases collected were operated upon for osteomyelitis and extensive caries. These all recovered; the recovery being recorded as permanent in one case.

(VII) INTERSCAPULO-THORACIC AMPUTATION FOR CARIES.—
THREE CASES.

CASE I (1840-1847, February 6).—William Fergusson, Edinburgh. Male, aged thirty-three. Caries of humerus and scapula.

(1) Disarticulation of humerus three years before. (2) Removal of scapula and outer part of clavicle. Recovery permanent. Ether was used in second operation. Healed, May 5. Recovery permanent (Rogers). Reference, *Medico-Chirurgical Transactions*, 1848, Vol. xxi, p. 309.

CASE II (1884, May 20).—Béranger, Féraud, Lorient. Male, aged twenty-four. Caries of scapula and humerus; osteomyelitis. Interscapulo-thoracic amputation: recovery. Reference, *Bulletin de Thérapéut.*, 1885, 55, année xi, pp. 490-552.

CASE III (1885, 1886, 1887, April 23).—Poncet, Paris. Female, aged twenty-six. Caries of left humerus and scapula. (1) Resection of head of humerus; (2) disarticulation of humerus; (3) removal of scapula and part of clavicle. Recovery. Reference, *Revue de Chirurgie*, Paris, 1887, Vol. vii, p. 996.

CASE IV (December, 1899).—George Ryerson Fowler. Osteomyelitis of humerus, with extensive infection of the soft parts. (1) Incision of abscess and curetting under an anæsthetic. (2) Repeated subsequent incision of pockets and curetting. (3) Pathological fracture; disarticulation at shoulder. (4) Extension of infection to and removal of part of scapula and clavicle. (5) Consecutive interscapulo-thoracic amputation. Hæmorrhage necessitating intravenous infusion during operation. Convalescence well established in a fortnight following. (Personal communication.)

Two cases were operated upon for tuberculosis.

(VIII) INTERSCAPULO-THORACIC AMPUTATION FOR TUBERCULOSIS.— TWO CASES.

CASE I (1896, April 15).—Schuyler C. Graves. Male, aged thirty-one. Tuberculosis of shoulder region. Sinuses. (1) Curetted, laid open, iodoformization, March 14, 1895; (2) curetted, July 11; (3) abscess opened, August 11; (4) excision of shoulder-joint, August 22; (5) interscapulo-thoracic amputation, two-thirds of the clavicle being removed. Axillary artery was ligated, but there was severe hæmorrhage. Sinus in flaps curetted. Intravenous infusion of one quart of hot saline solution into the radial vein. Recovery. Sinus persisted for eight months. On January 26, 1897, they were again curetted, irrigated with iodine, and packed with pure balsam of Peru. At the time of report sinus was practically healed. Reference, *Physician and Surgeon*, Detroit, 1897, Vol. xix, p. 264.

CASE II (1896, August 6).—William Bishop, New York. Male, aged fifty-two. Tuberculosis of shoulder region. Numerous sinuses. Two previous curettings. Interscapulo-thoracic amputation. No tubercle bacilli were found. Recovery. There was still a large granulating surface when reported. Reference, *The Hahnemannian Monthly*, Philadelphia, 1897, Vol. xxxii, pp. 43-48.

(IX) INTERSCAPULO-THORACIC AMPUTATION FOR INJURIES.—
TWENTY-SIX CASES.

The historic case which first showed surgeons the possibility of safely removing the entire upper extremity was that of Samuel Wood, a miller, whose arm with the scapula attached was torn from his body by the end of a rope becoming wound about his arm, the other end being entangled in the cogs of his mill. This accident occurred in 1737. The wound bled but little. The arteries and nerves, which the great force had drawn out from the arm, were placed in the wound and a dressing applied. Next day the case came under Mr. Ferne's care, at St. Thomas's Hospital. The dressings were not removed for several days. As there was sufficient skin to cover the wound, it healed quickly. Reference, "The Anatomy of the Human Body," by W. Cheselden, 7th Ed, 1750, Tab. XXXVIII, p. 321.

CASE I (1808).—Ralph Cumings, Antigua, E. I. Male, aged twenty-one. Gunshot injury. Interscapulo-thoracic amputation: recovery. Reference, *London Medical and Surgical Journal*, 1830, p. 81.

CASE II (1838, December 31).—Gaëtani Bey, Cairo. Male, aged fourteen. Explosion of a cannon. Shoulder crushed. Interscapulo-thoracic amputation (outer part of clavicle): recovery in two months. Suppuration without other complications. Reference, Omodei, *Annali Univers*, Vol. xcvi, 1841, S. 5; also *Medical and Surgical Journal*, 1842, p. 338.

CASE III (1838).—Larry. Male, aged fourteen. Gunshot comminution. Interscapulo-thoracic amputation; recovery. A castration was also done in this case. Reference, *American Journal*, 1868, Vol. lvi, p. 368; also "Résumé of Capital Surgical Operations," by Dr. C. B. Günther, Leipsic, 1861, p. 36.

CASE IV (1842).—Cooper, British Guiana. Machine injury (tore away arm and two-thirds of the scapula). Interscapulo-thoracic amputation (one-third of clavicle and rest of scapula): recovery. Reference, *American Journal*, 1868, Vol. lvi, p. 368.

CASE V (1845).—Winslow Lewis, Boston. Male. Comminuted fracture. Machinery accident. Interscapulo-thoracic amputation. Death soon after the operation from shock. There were, in addition, other severe injuries. Reference, *American Journal*, 1868, N. S. 56, p. 368.

CASE VI (1855, June 21).—Pirondi, Marseille. Male. Crushing of the shoulder. Interscapulo-thoracic amputation (two-thirds of clavicle). Death from hæmorrhage from laceration of the lung. Ligation of axillary artery. Reference, *Revue médicale de Chirurgie de Paris*; also von Brokerei, "Geschichte und Casuistik der Exstirpation des Schulterblattes," Dissertation, Berlin, 1869.

CASE VII (1856, August 26).—Parise, Lille. Male, aged sixteen and one-half months. Crushing of right shoulder and arm. Machinery accident. Interscapulo-thoracic amputation (one-half of clavicle): recovery. Preliminary ligation of subclavian artery and vein. Regeneration of scapula. In a drunken frenzy committed suicide in 1885. Reference, Communicated by the operator to Berger.

CASE VIII (1860, December 17).—Niepce, Avellard. Male, aged thirty-two. Comminuted fracture of the left clavicle, scapula, and humerus. Machinery accident. Interscapulo-thoracic amputation: recovery. Reference, *Bulletin de l'Académie de Médecine*, 1864-1865, Vol. xxx, p. 723.

CASE IX (1864, December).—Vincent Jackson, Wolverhampton. Male, aged thirty-five. Comminuted fracture of the right arm and forearm, also the scapula. Accident. Disarticulation of arm, removal of pieces of scapula. Death from shock after several hours. Reference, *British Medical Journal*, 1869, Vol. ii, N. S., p. 322.

CASE X (1869 ?).—Parise, Lille. Male, aged fourteen. Crushing of left arm and shoulder. Machinery accident. Interscapulo-thoracic amputation (one-half of the clavicle). Death in twelve days. Preliminary ligation of subclavian artery. Death from infection (?). Autopsy showed fracture of fifth and sixth cervical vertebræ, which had not been diagnosed. Reference, Communication of the operator to Berger.

CASE XI (1869).—Parise, Lille. Male, aged thirty-five. Crushing of left arm and shoulder. Machinery accident. Interscapulo-

thoracic amputation (one-half of the clavicle and most of the scapula). Death on eighth day. Traumatic pneumonia. Fracture of ribs with puncture of lung. Fracture of fifth cervical vertebrae. Reference, Communication of the operator to Berger.

CASE XII (1869, March 27).—Patrick Heron Watson, Edinburgh. Male, aged thirteen. Tearing away of part of the arm. Deltoid, axillary, pectoral, clavicular, and scapular region involved in the injury. Machinery accident. Interscapulo-thoracic amputation (part of the clavicle; only two ounces of blood were lost): recovery in seventy-four days. Twenty arteries ligated. Carbolic dressing. Suppuration. Later, zinc dressing. Wire sutures. Reference, *Edinburgh Medical Journal*, 1869, Vol. xv, Part i, p. 124.

CASE XIII (1870, September 14).—J. J. Charles, Belfast. Male, aged ten. Avulsion of the right arm and the scapula from the clavicle. Machinery accident. Interscapulo-thoracic amputation (part of clavicle): recovery. Chloroform. Carbolic dressing. Reference, *Lancet*, 1872, Vol. i, p. 216, February 17.

CASE XIV (1873, April 28).—Jessop. Male, aged fourteen. Comminuted fracture and avulsion of the humerus. Machinery accident. Interscapulo-thoracic amputation (one-third of the clavicle): recovery in twenty days. Air in subclavian vein. Skin-grafting. Reference, *British Medical Journal*, 1874, January 3, Vol. i, p. 12.

CASE XV (1876, December 10; 1877, January 26).—F. Gundrum. Male, youth. Gunshot injury of subclavian artery and soft parts, also shoulder-joint. Gangrene of arm and forearm and anterior part of shoulder. (1) Amputation through the humerus four or five inches from the head of the bone; (2) caries of humerus, one-half inch of clavicle supra- and infraspinous fossæ. Interscapulo-thoracic amputation (one and one-third inches of the clavicle): recovery. Considerable new bone-formation within eighteen months from the periosteum that was peeled from lower angle, superior angle, and inner border of the scapula. Reference, *American Journal*, 1878, Vol. lxxvi, p. 98.

CASE XVI (1879).—Weinlechner. Male, aged sixteen. Machinery injury. Arm torn away. Interscapulo-thoracic amputation: recovery. Reference, *Allgemeine Wiener Medizinische Zeitung*, 1878, Vol. xxiii, p. 116.

CASE XVII.—Wheelhouse. Male, youth. Injury. Interscapulo-thoracic amputation (part of clavicle): recovery. Reference, McGill (Berger, 49).

CASE XVIII (1884).—Lewis. Male (?). Comminuted fracture.

Interscapulo-thoracic amputation: died. Reference, Berger 41, Wyeth.

CASE XIX (1884, July 4).—J. Lucas Championière, Paris. Male, aged thirty-eight. Extensive injury of arm, scapula, and clavicle. Machinery accident. Separation of clavicle. Removal of scapula and arm. Recovery. Preliminary ligation of subclavian artery and vein. Reference, *Revue de Chirurgie*, Paris, 1886, Vol. vi, p. 529.

CASE XX (1885).—Schmidt. Male, aged seven. Railroad injury. Interscapulo-thoracic amputation (two-thirds of the clavicle): recovery. Reference, *Medical Press*, Western New York, 1885-86.

CASE XXI (1886, July 24).—Gaëtano Mazzoni, Rome. Comminuted fracture of the left arm and scapula. Interscapulo-thoracic amputation (without the clavicle and part of scapula): death at the end of thirty hours. Transfusion. Stimulation. Ligation of the subclavian artery. Death from œdema of lungs and acute anæmia. Reference, Agostino Paci, "Asportazione totale e resezioni parziali della scapola," *Lo Sperimentale*, 1887, November, p. 490.

CASE XXII (1887).—Kirmisson, Paris. Male, adult. Gunshot injury of the axilla. Fracture of clavicle. Emphysema of arm. Interscapulo-thoracic amputation (one hour after injury): death. Severe hæmorrhage. Reference, *Gazette des Hôpitaux*, 1887, p. 1009; also Adelman.

CASE XXIII (1887).—Jeannel. Male, aged twenty-six. Arm bitten off above elbow by a lion. Interscapulo-thoracic amputation (two-thirds of the clavicle): died in two and one-half hours. Reference, *Bulletin et Mémoires de la Société de Chirurgie de Paris*, 1886, N. S., Vol. xiv, p. 484.

CASE XXIV (1895, May 7).—Thomas F. Chavasse. Male, aged thirty-two. Machinery accident. Forearm torn away. Axillary vessels exposed, but not torn. Brachial plexus crushed, but not severed. Skin and shoulder much torn and devitalized. Interscapulo-thoracic amputation (two-thirds of the clavicle): recovery. Reference, *ANNALS OF SURGERY*, Philadelphia, 1896, Vol. xxiv, pp. 182-187.

CASE XXV (1895).—George Ryerson Fowler. (Here fully reported.) *Amputation of Entire Upper Extremity for Extensive Burns*.—P. R., aged fifty-five years, a stableman by occupation, was admitted to the Methodist Episcopal Hospital on November 17, 1895, with the history that he was found unconscious on the floor of his stable with his clothing afire and his lantern broken beside him. There were

extensive burns of entire surface of left arm and forearm. There was bleeding from nostrils and right ear, and ecchymosis of the left eye. Temperature 97.4° F., pulse 58, respiration 24.

His arm was dressed with compresses soaked in a solution of sodium bicarbonate. The nostrils and ear were irrigated with a solution of boric acid and packed with iodoform gauze. The patient complained of great pain in the arm. On the 19th (two days after admission) the moist sodium bicarbonate dressings were changed to unguentum zinci oxidi. During the next six or seven nights the patient was delirious and the pulse became intermittent. The temperature rose on the third day to 100.6° F. On the 28th (eleven days after admission) the entire arm was found to be sloughing and foul-smelling, and for the next six days was irrigated daily with a solution of potassium permanganate, and on December 3 amputation of entire upper extremity was recommended, but refused by the patient. On December 6 consent to amputation was obtained, and on December 7 (three weeks after admission) the operation was performed. The anæsthetic used was ether and oxygen.

Operation.—A four-inch incision was made over left clavicle down to the bone, and about three inches of bone resected. The subclavian artery was exposed by blunt dissection and ligated. From the incision over the clavicle an anterior incision was made downward along the anterior surface of the chest, about four inches to the left of the median line, just beyond the burned area. The incision was carried down as far as the fourth rib, across the axilla, then to the angle of the scapula, upward over the centre of the spine of scapula, and across the shoulder to the clavicular wound. The skin and subcutaneous tissues were dissected up for some distance from the incision. The attachment of the scapular muscles to the trunk were then successively divided, and the scapula and outer fragment of the clavicle removed with the arm. The flaps were sutured with silkworm gut and absorbent dressings applied.

The patient suffered profound shock, but reacted well to generous stimulation, and made a fair recovery from the anæsthetic.

From the fourth day after admission until the thirteenth day the temperature varied between 99.1° and 100.6° F., when it rose to 101.2°. On the morning after the operation, it rose to 101.3°, falling to 100.4° in the evening. Two days after the operation the patient was very restless, and seemed to have difficulty and distress in breathing, and began to cough frequently. Early that morning the patient became delirious, and the temperature rose to 103.2°;

pulse 145. Physical examination revealed fine crepitant râles all over the right chest at the end of inspiration, dullness on percussion all over the right lung and broncho-vesicular breathing. That afternoon the improvement in his mental condition, noted earlier in the day, changed, and he became again delirious, restless, and the temperature rose to 104° . The cough improved, but the pulse grew weaker and less frequent. The wound was dressed and found in good condition. The next morning the patient had a severe chill, lasting twenty-five minutes. He was restless, and towards morning wildly delirious. During the day his respirations became very difficult, the temperature rose to 104.6° , the pulse became very weak, finally imperceptible, and in the evening he died.

Autopsy showed right lung heavy and the lower lobe in a state of gray hepatization, which process extended into middle lobe. The upper lobe was markedly congested. The kidneys were in a state of chronic diffuse nephritis, and markedly cystic. The cause of death was found to be (1) pulmonitis; (2) chronic diffuse nephritis.

This table does not include those cases of complete avulsion of the arm and scapula which have been reported from time to time, but rather those cases in which extensive injury to the humerus, scapula, and soft parts in the neighborhood of the shoulder-joint, with, in many cases, injury of the clavicle, rendered conservation of the upper extremity an impossibility. The causative factor in the majority of these cases was accident by machinery. There are three cases of gunshot injury, with one death; one injury by explosion, which recovered; one injury by lion-bite, with death; one case from extensive burns, with death; the remainder, for the most part, machinery accidents, with death in six cases. Of the nine fatal cases the immediate cause of death is not given in one case; three died of shock shortly after the operation; two died of pneumonia (traumatic in one case), the one eight and the other three days after the operation; one of hæmorrhage from laceration of the lung; in the two remaining cases there were other severe injuries. We may then fix the mortality of interscapulo-thoracic amputation for injury at 36 per cent., or three times that for malignant disease.